

Advanced Composite Truss (ACT) Printing for Large Solar Array Structures, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

Large solar arrays (100 kW-1 MW) are required in order to generate the power necessary for solar electric propulsion to drive NASA's future missions, including: Asteroid Redirect Mission, Mars Exploration, and NASA Commercial Supply. The advantages and benefits of large solar array designs will only be realized if the array support structure weight and packaging volume are minimized. SDC's Advanced Composite Truss (ACT) additive manufacturing technology can provide a 30-40% weight savings and a 250-300% improvement in power per unit volume over existing state-of-the-art solar array boom structures. The ACT technology consists of the lightweight advanced composite truss, the autonomous low-packing volume ACT printer, and an integrated solar array deployment system. The weight of the ACT structure is designed to optimize the load carrying path within an open truss architecture. The material for the truss is efficiently packaged within the envelope of the ACT printer prior to launch. Once in orbit, the ACT printer autonomously manufactures the ACT structure without the need for mechanical joints. The ACT printer can be scaled to manufacture any size, length, and/or geometry truss required to meet the prescribed mission requirements. Following the manufacture of the ACT truss, the integrated drive system of the ACT printer autonomously deploys the solar array.

ANTICIPATED BENEFITS

To NASA funded missions:

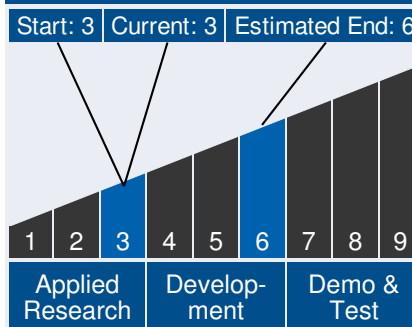
Potential NASA Commercial Applications: The primary market for the ACT additive manufacturing technology is large (100 kW-1 MW) solar arrays. However, the ACT system is reconfigurable, scalable, and reprogrammable, making it applicable to a large number of other space applications. The ACT system could also be implemented for structural reinforcement for the ISS or other space structures, structural booms for solar arrays on lightweight space structures, Mars colonization infrastructure, straight and



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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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curved primary structure on satellites or future space stations. SDC estimates that the ROI for launching the ACT system on five (5) different missions will exceed 3. The ACT system has direct applicability to the asteroid redirect mission, the Mars Exploration missions, and NASA commercial resupply missions.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The ACT system is being developed with complete printer and structure tailorability to meet a range of mission objectives. Additional applications include private space exploration spacecraft that employ solar electric propulsion, private space stations, and terrestrial applications including low wind resistant booms, light weight antenna structures, and tether satellite structures (electrodynamic and moment tethers). SDC estimates that if the ACT system could be utilized in a production environment (either in space or on earth), ROIs of 10-100 could be realized.

Management Team (cont.)

Principal Investigator:

- Quinn Mcallister

Technology Areas

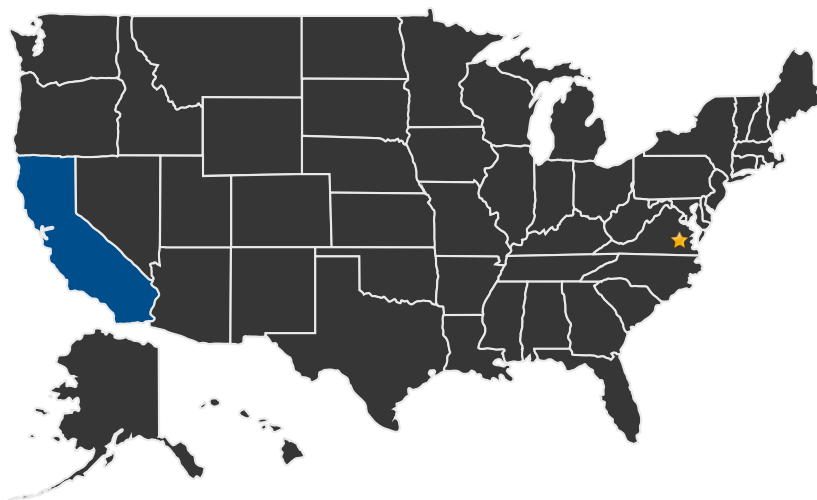
Primary Technology Area:

Materials, Structures, Mechanical Systems and Manufacturing (TA 12)

└ Structures (TA 12.2)

└ Lightweight Concepts (TA 12.2.1)

U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States
With Work

★ Lead Center:
Langley Research Center

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Other Organizations Performing Work:

- San Diego Composites, Inc. (San Diego, CA)

PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23506>)

IMAGE GALLERY



*Advanced Composite Truss (ACT)
Printing for Large Solar Array
Structures, Phase II*

DETAILS FOR TECHNOLOGY 1

Technology Title

Advanced Composite Truss (ACT) Printing for Large Solar Array Structures, Phase II

Potential Applications

The primary market for the ACT additive manufacturing technology is large (100 kW-1 MW) solar arrays. However, the ACT system is reconfigurable, scalable, and reprogrammable, making it applicable to a large number of other space applications. The ACT system could also be implemented for structural reinforcement for the ISS or other space structures, structural booms for solar arrays on lightweight space structures, Mars colonization infrastructure, straight and curved primary structure on satellites or future space stations. SDC estimates that the ROI for launching the ACT system on five (5) different missions will exceed 3. The ACT system has direct applicability to the asteroid redirect mission, the Mars Exploration missions, and NASA commercial resupply missions.